

## **CLAIMS**

I Claim:

- 1        1. An apparatus for coating fertilizer particles or  
2        pellets with a slow-release polymer comprising:
  - 3            a particle or pellet fertilizer preheater and drier;
  - 4            a rotating particle or pellet fertilizer coating drum;
  - 5            means for conveying preheated and dried fertilizer  
6        particles or pellets from said preheater and drier to said  
7        coating drum having a fertilizer particle or pellet entrance end  
8        and a product coated fertilizer exit end;
  - 9            a product coated fertilizer cooler and retainer; and  
10          means for collecting and conveying product coated  
11        fertilizer particles or pellets from said rotating coating drum  
12        to said product coated fertilizer cooler and retainer;
  - 13          said rotating coating drum having a source for isocyanate  
14        pre-polymer and a source for reacting combined fluid;
  - 15          said rotating coating drum having a central axis and  
16        comprising:
    - 17            an axially located center beam coating station  
18        support;
    - 19            a plurality of coating stages spaced along said center  
20        beam;

21           means for directing said isocyanate pre-polymer from  
22           said source of isocyanate pre-polymer to each of said  
23           stages;

24           means for directing said reacting combined fluid from  
25           said source of combined fluid to each of said stages;

26           a nozzle connected with said means for directing  
27           isocyanate pre-polymer and located at each said stage, said  
28           nozzle being directed for discharge of isocyanate pre-  
29           polymer toward said fertilizer particles or pellets; and

30           a corresponding nozzle connected with said means for  
31           directing reacting combined fluid and located at each said  
32           stage, said nozzle being directed for discharge of reacting  
33           combined fluid toward said particles or pellets;

34           each said isocyanate monomer directing nozzle and said  
35           corresponding combined fluid nozzle being located at about  
36           the same position lengthwise relative to said center beam  
37           support at each of said plurality of stages;

38           said coated fertilizer product cooler and retainer  
39           receiving hot product from said coating drum and cooling said  
40           product to ambient temperature.

1           2. A coating apparatus according to claim 1, wherein said  
2           fertilizer preheater and drier is a rotating drum.

1       3. A coating apparatus according to claim 1, wherein said  
2 coated fertilizer product cooler and retainer is a rotating  
3 cooling and retention drum.

1       4. A coating apparatus according to claim 1, wherein said  
2 source for isocyanate pre-polymer source is a first tank and  
3 feed line and said means for directing isocyanate pre-polymer  
4 from said source to each of said stages is a first header  
5 supported by said center beam and fluidly connecting said first  
6 feed line and said first header.

1       5. A coating apparatus according to claim 4, wherein said  
2 source for reacting combined fluid is a second tank and feed  
3 line and said means for directing combined fluid from said  
4 source to each of said stages is a second header supported by  
5 said center beam and fluidly connecting said second feed line  
6 and said second header, said second tank having means for  
7 stirring said combined fluid held therein.

1       6. The coating apparatus according to claim 5, wherein  
2 each said nozzle for discharge of isocyanate monomer comprises a  
3 spray head for spraying isocyanate monomer toward said  
4 fertilizer particles or pellets, and wherein each said  
5 corresponding nozzle for discharge of combined fluid comprises a  
6 spray head for spraying combined fluid toward said fertilizer  
7 particles or pellets so as to form a coating stage within said  
8 rotating coating drum.

1       7. The coating apparatus according to claim 6, wherein  
2 there are four coating stages formed within said rotating  
3 coating drum each having an isocyanate pre-polymer spray head  
4 and a corresponding combined fluid spray head, and wherein said  
5 coating drum has a pitch of about 15 degrees downward from said  
6 fertilizer particle or pellet entrance end and said coated  
7 product exit end, said fertilizer particles or pellets moving  
8 through each said coating stage as they travel between said  
9 entrance end and said exit end.

1       8. The coating apparatus according to claim 3, further  
2 comprising a storage bin and a collecting conveyer located  
3 between said cooling and detention drum and said storage bin for  
4 collecting cooled, coated fertilizer product from said cooling  
5 and detention drum and conveying the cooled, coated fertilizer  
6 product to said storage bin for storage therein.

1       9. A method for coating fertilizer particles to impart to  
2 them slow plant nutrient release comprising:

3            preheating to from about 125 to about degrees F and drying  
4 said fertilizer particles;

5            simultaneously spraying said preheated particles with an  
6 isocyanate pre-polymer and a reacting combination fluid  
7 comprising:

8            a polyol;

9                   a methyl ester derivative of a plant or vegetable  
10                 oil;

11                 a polymerization catalyst; and  
12                 a powder extender;

13                 reacting said isocyanate pre-polymer and said reacting  
14                 combination fluid to form a polymer coating on said fertilizer  
15                 particles; and

16                 cooling said coated fertilizer particles to form a slow  
17                 release fertilizer product.

1                 11. The method of claim 10, wherein said powder extender  
2                 in said reacting combination fluid comprises barium sulfate.

1                 12. The process of claim 9, wherein said combination fluid  
2                 further comprises an oil-based dye.

1                 13. The method of claim 11, wherein said isocyanate pre-  
2                 polymer is selected from the group comprising diphenylmethane  
3                 diisocyanate, toluene diisocyanate, and polymeric  
4                 diphenylmethane diisocyanate.

1                 14. The method of claim 11, wherein said polyol is  
2                 selected from the group comprising polyester polyol, polyether  
3                 polyol, and polyethylene glycol.

1                 15. The method of claim 11, wherein said polymerization  
2                 catalyst is selected from the group comprising dibutyl tin  
3                 dilaurate, triethylene diamine, and methyl diethanol amine.

1       16. The method of claim 11, wherein said methyl esters of  
2 plant or vegetable oils are selected from the methyl esters of  
3 cotton seed oil, linseed oil, and soybean oil.

1       17. The method of claim 16, wherein said combined fluid  
2 further comprises plant or vegetable oils selected from the  
3 group comprising cotton seed oil, linseed oil, waxes selected  
4 from the group comprising paraffin and micro-crystalline waxes,  
5 and powders selected from the group comprising diatomaceous  
6 earth, calcium carbonate, clays, and silicas.

1       18. The method of claim 11, wherein said spraying step and  
2 reacting steps are repeated a number of times corresponding to  
3 the number of layers of coating desired on said fertilizer  
4 particles.

1       19. The method of claim 11, wherein for each pound of  
2 fertilizer particles coated, about six grams of a pre-polymer  
3 and a reacting combination fluid comprising about three grams  
4 polyether polyol, about three grams soy bean oil methyl ester,  
5 about one-fourth gram dibutyl tin dilaurate catalyst, and about  
6 three grams barium sulfate are applied by spraying.

1       20. The method of claim 19, wherein said reacting  
2 combination fluid further comprises a quantity of oil-based dye.

1       21. The method of claim 11, wherein said reacting  
2 combination fluid further comprises and micro-nutrients, said

3 micro-nutrients being selected from the group comprising copper  
4 compounds and zinc compounds.

1       22. The method of claim 11, wherein said reacting  
2 combination fluid further comprises pesticides.

1       23. The method of claim 19, wherein said spraying step and  
2 said reacting step are repeated plurality of times resulting in  
3 a corresponding plurality of coating layers on said fertilizer  
4 particles.

1       24. The method of claim 23, wherein said spraying and  
2 reacting steps are successively carried out in stages as said  
3 fertilizer particles travel through a multi-stage coating drum  
4 resulting in fertilizer particles having four coatings.

1       25. The method of claim 24, wherein there are four  
2 spraying and reacting steps carried out in four stages.

1       26. The method of claim 11, wherein said fertilizer  
2 particles are selected from the group comprising granules,  
3 chunky granules, prills, pellets, extrusion, shot, lumps,  
4 grains, crystals, and flakes.

1       27. The method of claim 26, wherein said fertilizer  
2 particles consist of sulfate based fertilizers.

1       28. The method of claim 27, wherein said fertilizer  
2 particles consist of potassium sulfate.

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29. The product of the process of claim 28.

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